

IN THE CLAIMS

1. (cancelled)
2. (previously presented) A switching method for selectively directing an input beam to  
5 at least one of two output channels, the method comprising:
  - (i) providing incidence of the input beam onto a polarizing beam splitting surface to thereby enable splitting of the input beam into two beam components of different polarizations propagating along different optical paths;
  - (ii) passing the input beam components of different polarizations through a  
10 controllable polarization rotating medium operable to selectively affect the polarization of each of the beam components; and
  - (iii) directing the beam components that have passed through the polarization rotating medium onto said polarizing beam splitting surface, thereby producing at least one output beam propagating towards at least one selected  
15 output channel, depending on a current mode of said medium;wherein the input beam passes through the controllable polarization rotating medium prior to being split into said two beam components of different linear polarization states.
3. (previously presented) The method according to claim 2, wherein steps (i) - (iii) are  
20 repeated with respect to said at least one output beam by directing it towards an additional polarizing beam splitting surface, and passing split beam components of said at least one output beam through an additional controllable polarization rotating medium capable of affecting polarizations of the split beam components, and an additional beam directing means that directs the beam components onto said additional polarizing beam splitting  
25 surface, thereby producing at least one additional output beam propagating towards a selected additional output channel.

4-5 (canceled)

- 30 6. (previously presented) A switching method for selectively directing an input beam to at least one of two output channels, the method comprising the steps of:

- (i) providing incidence of the input beam onto a polarizing beam splitting surface to thereby enable splitting of the input beam into two beam components of different polarizations propagating along different optical paths;
  - 5 (ii) passing at least one of the input beam components through an optical filtering means accommodated in the optical path of said at least one input beam component, thereby enabling to filter light that has interacted with the polarizing beam splitting surface to correct for an error introduced by the polarizing beam splitting surface;
  - 10 (iii) passing the input beam components of different polarizations through a controllable polarization rotating medium operable to selectively affect the polarization of each of the beam components; and
  - 15 (iv) directing the beam components that have passed through the polarization rotating medium onto said polarizing beam splitting surface, thereby producing at least one output beam propagating towards at least one selected output channel, depending on a current mode of said medium.
7. (original) The method according to Claim 6, wherein the split beam component passing through the filtering means is a beam component reflected from the polarizing beam splitting surface, said filtering means comprising an additional polarizing beam splitting surface; light reflected from said additional polarizing beam splitting surface propagating towards the controllable polarization rotating medium.
- 20
8. (original) The method according to Claim 6, wherein the split beam component passing through the filtering means is a beam component transmitted through said polarizing beam splitting surface, said filtering means comprising a polarization rotating element capable of 90°-rotating the polarization of the incident beam component, and a polarizing beam splitting surface, light passed through said polarization rotating element and reflected from said additional polarizing beam splitting surface propagating towards said controllable polarization rotating medium.
- 25
- 30

9. (previously presented) A switching method for selectively directing an input beam to at least one of two output channels, the method comprising the steps of:

- (i) providing incidence of the input beam onto a polarizing beam splitting surface to thereby enable splitting of the input beam into two beam components of different polarizations propagating along different optical paths;
- 5 (ii) providing incidence of the input beam components onto a controllable polarization rotating medium operable to selectively affect the polarization of each of the beam components, with an incidence angle other than 90 degrees;
- (iii) passing the input beam components through said medium; and
- 10 (iv) directing the beam components that have passed through the polarization rotating medium onto said polarizing beam splitting surface, thereby producing at least one output beam propagating towards at least one selected output channel, depending on a current mode of said medium.

15 10. (previously presented) A switching method for selectively directing an input beam to at least one of two output channels, the method comprising the steps of:

- (i) providing incidence of the input beam onto a polarizing beam splitting surface to thereby enable splitting of the input beam into two beam components of different polarizations propagating along different optical paths;
- 20 (ii) passing the input beam components of different polarizations through a controllable polarization rotating medium operable to selectively affect the polarization of each of the beam components; and
- (iii) directing the beam components that have passed through the polarization rotating medium onto said polarizing beam splitting surface, thereby producing at least one output beam propagating towards at least one selected output channel, depending on a current mode of said medium;

25 wherein said medium is operated to provide a desired difference in phase delay in a range 0 -  $\lambda/2$  between two principal axes of said medium, thereby enabling to obtain desirable partition between the two output channels.

30 11. (previously presented) The method according to claim 10, used for multicast switching.

12. (previously presented) The method according to claim 10, wherein one of the output channels is blocked, thereby enabling variable attenuating.
13. (previously presented) The method according to claim 2, wherein an electrostatic field applied to said medium is selected such as to compensate for a hysteresis phenomenon occurring in said medium.
14. (previously presented) The method according to claim 2, wherein an electrostatic field applied to said medium is selected so as to fit phases of the beam components passing therethrough, thereby compensating for a phase shift caused by beam reflection effects during the beam propagation.
15. (previously presented) The method according to claim 2, wherein an electrostatic field applied to said medium is such as to cause a difference of  $\lambda/2$  in phase delay between the split beam components of different polarizations, the method thereby enabling to reduce switching differential voltage requirements.
16. (canceled)
17. (currently amended) The device according to claim 26, wherein said medium exhibits ~~is of a kind based on an~~ electro-optic effect.
18. (original) The device according to Claim 17, wherein said electro-optic effect is a linear effect.
19. (original) The device according to Claim 18, wherein said medium is made of ferroelectric crystals.
20. (previously presented) The device according to claim 57, where said medium is lithium niobate.
21. (previously presented) The device according to claim 57, where said medium exhibits a quadratic electro-optic effect.

22. (original) The device according to Claim 21, wherein said medium is made of ceramics.
23. (original) The device according to Claim 22, wherein said ceramics is Lead Lanthanum Zirconate Titanate (PLZT).
- 5 24. (previously presented) The device according to claim 26, wherein said medium is made of a liquid crystal (LC) material.
- 10 25. (previously presented) The device according to claim 26, operating as one of the following switches: 1x2, 2x1, 2x2.
26. (currently amended) An all-optical switch device for selectively directing an input beam to at least one of two output channels, the device comprising:
- 15 (a) a polarizing beam splitting surface capable of splitting an input beam into two beam components of different polarizations and directing the split beam components to propagate along different optical paths, and capable of combining two beam components of different polarizations to produce at least one output beam;
- (b) a controllable polarization rotating medium accommodated in optical paths of the input beam components, and selectively operable to affect the polarization thereof;
- 20 and
- (c) beam directing means accommodated in optical paths of the beam components passed through the polarization rotating medium for directing the beam components onto said polarizing beam splitting surface to thereby produce at least one output beam propagating towards at least one selected output channel;
- 25 wherein the controllable polarization rotating medium comprises two elements made of a polarization rotating material, and said beam directing means comprises two retro-reflective elements associated with said two polarization rotating elements, respectively, so as to reflect the beam components of different polarization of the input beam towards the polarization rotating elements, and reflect the beams passed through the polarization
- 30 rotating elements onto said polarizing beam splitting surface.

27. (original) The device according to Claim 26, wherein said two polarization rotating elements and beam directing elements associated therewith are accommodated at opposite sides of said polarizing surface, respectively.
28. (original) The device according to Claim 27, wherein said polarizing beam splitting surface is a surface of a polarizing beam splitter made of a controllable polarization rotating material, said two polarization rotating elements being presented by two halves of the beam splitter at the opposite sides of the polarizing beam splitting surface.
29. (original) The device according to Claim 28, wherein said two beam directing elements are formed by reflective surfaces of the polarizing beam splitter.
30. (original) The device according to Claim 26, wherein each of the two beam directing elements is in the form of a two-part mirror, the corresponding one of the polarization rotating element being accommodated in a space between the two parts of the respective beam directing element.
31. (currently amended) An all-optical switch device for selectively directing an input beam to at least one of two output channels, the device comprising:
- (a) a polarizing beam splitting surface capable of splitting an input beam into two beam components of different polarizations and directing the split beam components to propagate along different optical paths, and capable of combining two beam components of different polarizations to produce at least one output beam;
- (b) a controllable polarization rotating medium accommodated in optical paths of the input beam components, and selectively operable to affect the polarization thereof;
- (c) beam directing means accommodated in optical paths of the beam components passed through the polarization rotating medium for directing the beam components onto said polarizing beam splitting surface to thereby produce at least one output beam propagating towards at least one selected output channel;
- 30 wherein the beam directing means is at least partly incorporated within the controllable polarization rotating medium.

32. (original) The device according to Claim 31, wherein the controllable polarization rotating medium comprises two elements made of a polarization rotating material, and said beam directing means comprises two retro-reflective elements associated with said two polarization rotating elements, respectively, so as to reflect the beam components of  
5 different polarizations of the input beam towards the polarization rotating elements, and reflect the beams passed through the polarization rotating elements onto said polarizing beam splitting surface.
33. (original) The device according to Claim 32, wherein said two beam directing elements comprises surfaces of two polarization rotating elements, respectively.  
10
34. (original) The device according to Claim 33, wherein the two polarization rotating elements are in the form of two corner prisms, respectively, having reflective inner surfaces, the corner prisms thereby serving as both the polarization rotating and the beam  
15 directing means.
35. (original) The device according to Claim 33, wherein the two polarization rotating elements are in the form of two penta-like prisms, respectively, having reflective inner surfaces, the corner prisms thereby serving as both the polarization rotating and the beam  
20 directing means.
36. (original) The device according to Claim 32, wherein said two beam directing elements are formed by inner surfaces of two substantially V-shaped structures, respectively, made of the polarization rotating material.  
25
37. (original) The device according to Claim 26, wherein said polarizing beam splitting surface is a surface of a polarizing beam splitter cube, which has two pairs of reflective surfaces shaped as two-part right-angle prisms defining two groove-like spaces, said two beam directing elements being presented by said reflective surfaces of the beam  
30 splitter, each of said two polarization rotating elements being accommodated inside the beam splitter within said groove-like spaces, respectively.

38. (original) The device according to Claim 31, wherein said polarizing beam splitting surface is a surface of a polarizing beam splitter cube, which has three truncated corners forming three locally adjacent facets, such that the intermediate facet intercepts with a plane of said polarizing beam splitting surface, said polarization rotating means 5 being in the form of two plates made of a polarization rotating material accommodated at the other two facets of the beam splitter, said beam directing means being formed by two reflective surfaces of said plates and a reflective surface of the intermediate facet, said reflective surfaces of the plates being rear surfaces with respect to the directions of beam propagation to the plates.

10

39. (currently amended) An all-optical switch device for selectively directing an input beam to at least one of two output channels, the device comprising:

- (a) a polarizing beam splitting surface capable of splitting an input beam into two beam components of different polarizations and directing the split beam components to 15 propagate along different optical paths, and capable of combining two beam components of different polarizations to produce at least one output beam;
  - (b) a controllable polarization rotating medium accommodated in optical paths of the input beam components, and selectively operable to affect the polarization thereof; and
  - 20 (c) beam directing means accommodated in optical paths of the beam components passed through the polarization rotating medium for directing the beam components onto said polarizing beam splitting surface to thereby produce at least one output beam propagating towards at least one selected output channel;
- wherein said polarizing beam splitting surface is a surface of a polarizing cubic beam splitter, which has three truncated corners forming three locally adjacent facets, such that the intermediate facets intercepts with a plane of said polarizing beam splitting surface, said polarization rotating means being in the form of a plate accommodated at the intermediate facet outside of the beam splitter and having a reflective surface, said beam directing means being formed by said reflective surface of the plate and reflective surface 25 of the other two facets.
- 30

40. (previously presented) The device according to claim 57, wherein said polarizing beam splitting surface is a surface of a polarizing beam splitter cube, said beam directing means including reflective surfaces of the polarizing beam splitter.
- 5 41. (currently amended) The device according to claim 57, wherein said beam directing means are also accommodated in the optical paths of the split beam components of the input beam to direct said beam components to the polarization rotating means.
- 10 42. (previously presented) The device according to claim 57, and also comprising optical filtering means accommodated in the optical path of at least one of the beam components propagating toward the controllable polarization rotating medium, thereby enabling to filter light passed through the polarizing beam splitting surface to correct for an error introduced by the polarizing beam splitting surface.
- 15 43. (original) The device according to Claim 42, wherein the filtering means is accommodated in the optical path of the split beam component reflected from the polarizing beam splitting surface, said filtering means comprising an additional polarizing beam splitting surface, light reflected from said additional polarizing beam splitting surface reaching the controllable polarization rotating medium.
- 20 44. (original) The device according to Claim 42, wherein the filtering means is accommodated in the optical path of the split beam component transmitted through said polarizing beam splitting surface, said filtering means comprising a polarization rotating element capable of 90°-rotating the polarization of the incident beam component, and a polarizing beam splitting surface, light passed through said polarization rotating element and reflected from said additional polarizing beam splitting surface propagating towards said controllable polarization rotating medium.
- 25 45. (canceled)
- 30 46. (previously presented) The device according to claim 57, operating as one of the following switches: 1x2, 2x1, 2x2.

47. (previously presented) A multi-stage all-optical switch structure comprising at least two switch devices, each constructed according to claim 57, the structure thereby operating as one of the following switches: 1x2, 2x1, 2x2.

- 5 48. (previously presented) A multi-stage all-optical switch structure comprising:
- (i) an array of at least first and second switches, each switch according to claim 57; and
  - (ii) at least one beam-directing element accommodated in an optical path of the output beam produced by the first switch device to direct said output beam onto the 10 polarizing beam splitting surface of the second switch device.

49. (currently amended) A switching method for reducing crosstalk between output channels of a switching structure where output light signals are collected, the method utilizing beam propagation through the switching structure composed of three switch 15 devices, each device comprising:
- (a) a polarizing beam splitting surface capable of splitting an input beam into two beam components of different polarizations and directing the split beam components to propagate along different optical paths, and capable of combining two beam components of different polarizations to produce at least one output beam;
  - 20 (b) a controllable polarization rotating medium accommodated in optical paths of the input beam components, and selectively operable to affect the polarization thereof; and
  - (c) beam directing means accommodated in optical paths of the beam components passed through the polarization rotating medium for directing the beam components onto 25 said polarizing beam splitting surface to thereby produce at least one output beam propagating towards at least one selected output channel;
- and having two output channels, wherein the two output channels of the first switch device are two input channels of, respectively, the second and third switch devices, one of the output channels of the second switch device and one of the output channels of the third 30 switch device being blocked to prevent light output therethrough, light signals collected at unblocked output channels of the second and third switch devices being thereby characterized by reduced crosstalk.

50. (previously presented) A switching method according to claim 49, for increasing a switching speed, wherein the controllable polarization rotating medium of each of the three switch devices is operable to rotate the polarizations of the beam components passing therethrough at an angle other than 90 degree.

5

51. (previously presented) The switching method for directing an input beam towards two output channels with a desired energy partition between the two output channels, the method utilizing light propagation through a switch device constructing according to claim 57, wherein said medium is operated to provide a desired difference in phase delay in a 10 range 0- $\lambda/2$  between two principal axes of said medium.

52. (previously presented) A switching method for directing an input beam toward a selected one of two output channels with the other output channel being blocked, to thereby enable variable energy attenuating, the method utilizing light propagation through 15 the switch device constructed according to claim 57, wherein said medium is operated to provide a desired difference in phase delay in a range 0- $\lambda/2$  between two principal axes of said medium.

53. (previously presented) A switching method for directing an input beam towards at 20 least one output channel, the method utilizing light propagation through the switch device constructed according to claim 57, wherein operation of said controllable polarization rotating medium is appropriately controlled to compensate for a hysteresis phenomenon occurring in said medium.

25 54. (previously presented) A switching method for directing an input beam towards at least one output channel in a manner to reduce switching differential voltage requirements, the method utilizing the switch device constructed according to claim 57, wherein operation of said controllable polarization rotating medium is appropriately controlled such as to cause a difference of  $\lambda/2$  in phase delay between the split beam components of 30 different polarizations.

55. (canceled)

56. (previously presented) The method according to claim 9, wherein steps (i) - (iii) are repeated with respect to said at least one output beam by directing it towards an additional polarizing beam splitting surface, and passing split beam components of said at least one  
5 output beam through an additional controllable polarization rotating medium capable of affecting polarizations of the split beam components, and an additional beam directing means that directs the beam components onto said additional polarizing beam splitting surface, thereby producing at least one additional output beam propagating towards a selected additional output channel.

10

57. (currently amended) An all-optical switch device for selectively directing an input beam to at least one of two output channels, the device comprising:

- (a) a polarizing beam splitting surface capable of splitting an input beam into two beam components of different polarizations and directing the split beam components to propagate along different optical paths, and capable of combining two beam components of different polarizations to produce at least one output beam;  
15 (b) a controllable polarization rotating medium accommodated in optical paths of the input beam components, and selectively operable to affect the polarization thereof; and  
20 (c) beam directing means accommodated in optical paths of the beam components passed through the polarization rotating medium for directing the beam components onto said polarizing beam splitting surface to thereby produce at least one output beam propagating towards at least one selected output channel;

wherein said medium is selected from the group consisting of lithium niobate ( $\text{LiNbO}_3$ )  
25 and materials exhibiting a quadratic electro-optic effect.

58. (previously presented) A multi-stage all-optical switch structure comprising:

- (i) an array of at least first and second switches, each switch according to claim 26; and  
30 (ii) at least one beam-directing element accommodated in an optical path of the output beam produced by the first switch device to direct said output beam onto the polarizing beam splitting surface of the second switch device.

59. (previously presented) A multi-stage all-optical switch structure comprising:

- (i) an array of at least first and second switches, each switch according to claim 31;  
and  
5 (ii) at least one beam-directing element accommodated in an optical path of the output beam produced by the first switch device to direct said output beam onto the polarizing beam splitting surface of the second switch device.

60. (previously presented) A multi-stage all-optical switch structure comprising:

- 10 (i) an array of at least first and second switches, each switch according to claim 39;  
and  
10 (ii) at least one beam-directing element accommodated in an optical path of the output beam produced by the first switch device to direct said output beam onto the polarizing beam splitting surface of the second switch device.